REMARKS

Amendments

Claim 1 is amended to incorporate the recitation of claim 3. Thus, claim 1 now corresponds to original claim 3 written in independent form. As a result of this amendment, claim 2 is cancelled; claim 4 is amended to depend from claim 1; claims 27 and 30 are amended to depend from claim 7; claims 33 and 44-46 are amended to depend from claim 4; and claim 34 is amended to depend from claim 5. Also, claim 43 is amended to depend from claim 7.

New claim 48 is similar to amended claim 1, but does not recite extraction means. New claim 49 is similar to claim 48, but does not specify the thickness of each reaction zone.

Proposed Drawing Correction

Attached is a proposed drawing correction for Figure 2 in which reference numeral 21 has been replaced by numeral 5. See, e.g., the discussion of Figures 1 and 2 in the text bridging pages 14 and 15. Approval of the proposed drawing correction is respectfully requested.

Objection to the Specification

There is no requirement under the statutes, Rules or in the MPEP that applicants' specification must contain headings. Rule 77(c), which refers to the use of headings, says the specification "should" contain such headings, not that the specification shall or must contain such headings. Withdrawal of the objection is respectfully requested.

In any event, applicants have inserted the headings for Brief Description of the Drawings and Detailed Description of the Drawings.

Objection to the Claims

Claim 3 is cancelled, thus making the objection to claim 3 moot. It is noted that the reference numerals S1 and S2 in claim 1 are in parentheses. Claim 43 is amended to depend from claim 7, rather than claim 14. Withdrawal of the objections is respectfully requested.

Rejection under 35 USC §103 in view of Stone and Luckenbach et al.

Claims 1, 5, 6, 8-10, 14, 32, 39, 43 and 47 are rejected as allegedly being obvious in view of Stone (US '794) in combination with Luckenbach et al. (US '243). This rejection is respectfully traversed.

This rejection was not applied against original claim 3, which has now been incorporated into claim 1. Neither of the references discloses a catalyst bed in the form of a moving bed, wherein the reaction zone(s) of one stage is connected to the reaction zone(s) of a lower stage via at least one passage with a cross section that is reduced with respect to the cross section of the reaction zone. Compare applicants' claims 1, 48, and 49. Withdrawal of the rejection is respectfully requested.

Stone (US '794) discloses a moving bed reactor. Referring to the Figure, the reactor contains a single, down flowing annular moving catalyst bed 6. Reactants are introduced into reaction zone 1 via the top central inlet 2, pass radially outward through catalyst containment screen 5 into moving bed 6, exit the bed through outer catalyst containment screen 7, and enter outer annular space 8.

The reaction fluid is then removed from annular space 8 and discharged from the reactor via line 11. The fluid is delivered to an external heater 60 and then reintroduced into the reactor via line 14. The fluid enters zone 2 of the reactor and pass radially inwardly through the moving catalyst bed 6 and is collected in a central collection pipe 17. The fluid then passes from collection pipe 17 radially outward through catalyst bed 6 into an annular collection zone 18. Thereafter, the fluid is removed from the reactor via line 19, delivered to external heater 61, and then reintroduced into the reactor at zone 3 where the fluids again pass radially inwardly through the moving bed 6. Stone thus discloses subjecting the reaction fluid to external heat exchange between zones 1 and 2 and zones 2 and 3. Stone does not provide any disclosure or suggestion of performing such a heat exchange within the reactor itself.

Luckenbach et al. (US '243) discloses a fluidized bed reactor, not a moving bed reactor as disclosed by Stone. In column 1, lines 45-67, Luckenbach et al. describe advantages of fluidized beds, not moving beds. One of the advantages is said to be the ability to avoid hot spots within the bed. In the case of exothermic reactions, Luckenbach et al. disclose that a heat exchanger

system can be provided inside the fluidized bed reactor vessel to remove "reaction heat owing to the fluid bed properties."

This alleged "advantage" of fluidized beds provides no suggestion of modifying a moving bed, as in the case of Stone (US '794). Moreover, the heat exchange described by Luckenbach et al. occurs within the fluidized bed. Luckenbach et al. does not describe or suggest providing heat exchange within a moving bed reactor between two successive reaction zones.

Moreover, while Luckenbach et al. refers to a possible advantage of providing heat exchange within fluidized beds, the heat exchange system that Luckenbach et al. use in its invention is an external heat exchanger, not an internal one. As illustrated in the figures of Luckenbach et al., gas is removed above a baffle, cooled in external heat exchanger 15, compressed in compressor 16, heated external 17, and then reintroduced into the reactor. Clearly, the overall disclosure does not provide motivation to use an internal heat exchanger, rather than an external one.

The Examiner comments and interpretation regarding "stages" as recited in the claims do not appear to be consistent with the clear language of the claims. Claim 1 clearly recites that the vessel comprises at least two stages in the vertical direction and that there is at least one catalytic reaction zone per stage which extends substantially along the axis of the vessel. Claim 5 recites that the vessel comprises at least two stages with at least two reaction zones per stage.

As shown in the Figure, Stone has actually four zones in the vertical direction, since zone 2 has actually two subzones in the vertical direction. Each of these four zones in the vertical direction has only one annularly shaped catalytic reaction zone.

The Examiner allegation that a circle is an ellipse is unsupported. As for claims 14, 39, and 43, Stone discloses an external heat exchanger between zones 1 and 2 and between zones 2 and 3. Internal heat exchangers between such zones are not suggested. As for claim 47, this claim recites a material contained within the vessel, and thus is a feature which can not be simply ignored.

In view of the above remarks, it is respectfully submitted that Stone (US '794), taken alone or in combination with Luckenbach et al. (US '243), fails to render obvious applicants'

claimed invention. Withdrawal of the rejection under 35 USC § 103 is respectfully requested.

Rejection under 35 USC §103 in view of Stone, Luckenbach et al., and Lengemann

Claims 2-4, 26-31, 33-35, 44, and 46 are rejected as allegedly being obvious in view of Stone (US '794) in combination with Luckenbach et al. (US '243) and Lengemann (US '866). This rejection is respectfully traversed.

The disclosures of Stone and Luckenbach et al. are discussed above. Lengemann (US '866) discloses a moving bed reactor which provides countercurrent flow of reactants and catalysts. As shown in the figure, the catalyst bed is retained between inner catalyst retention screen 11 and outer catalyst retention screen 6 to form an annular shaped bed. Fresh catalyst is introduced at the top of the bed via valve 4 and catalyst distribution ducts 5. Deactivated catalyst is removed from the bottom of the reactor via collecting ducts 12 and valves 13.

The catalyst bed is split up into several "passes." As catalyst descends from an upper pass to a lower pass, it is channelled through ports 9 which have a smaller diameter than the passes. US '866 disclose that the function of the ports is to prevent reactants from flowing upward through the catalysts bed between the passes. As shown in the figure, the reactant gases are intended to flow to radially through each of the catalysts beds.

US '866 does not overcome the deficiencies described above with regards to the combination of US '794 and US '243. US '866 does not describe or suggest modifying a moving bed reactor, such as in the case of US '794, to provide heat exchange for reaction fluids wherein heat exchange is achieved inside the vessel between two successive reaction zones.

In view of the above remarks, it is respectfully submitted that US '794, taken alone or in combination with US '243 and/or US '866, fails to render obvious Applicants' claimed invention. Withdrawal of the rejection under 35 USC § 103 is respectfully requested.

Rejection under 35 USC §103 in view of Stone, Luckenbach et al., and Kroger

Claims 13, 36 and 42 are rejected as allegedly being obvious in view of Stone (US '794) in combination with Luckenbach et al. (US '243) and Kroger (US '989). This rejection is respectfully traversed.

The disclosures of US '794 and US '243 are discussed above. Kroger (US '989) discloses a thin tube heat exchanger, said to be "particularly for the condensation of exhaust streams of large turbine plants by cooling air." At column 1, lines 37-42, US '989 disclose that the exchanger provides substantially increased outer heat transfer between the cooling air and the heat exchange cooling tube surfaces without significantly increasing pressure loss.

In the rejection, it is argued that Stone (US '794) discloses a pressure tight vessel and thus it would have been obvious to use the heat exchanger of US '989 within the reactor of US' 794 in order to maintain the pressure of the vessel. This rationale is unclear. Merely, because the vessel of US' 794 is pressure tight does not imply that there needs to be taken any extraordinary measures so as to assure that no pressure drop occurs through the vessel itself.

In any event, neither US '794 nor US '243, nor for that matter US '989, provide any suggestion of modifying the moving bed reactor of US '794 so as to provide heat exchange within the vessel reactor itself. As a result, there is also no motivation to use the heat exchanger of US '989 within the reactor of US '794.

In view of the above remarks, it is respectfully submitted that US '794, taken alone or in combination with US '243 and/or US '989, fails to render obvious applicants' claimed invention. Withdrawal of the rejection under 35 USC § 103 is respectfully requested.

Rejection under 35 USC §103 in view of Stone, Luckenbach et al., Lengemann and Kroger

Claim 45 are rejected as allegedly being obvious in view of Stone (US '794) in combination with Luckenbach et al. (US '243), Lengemann (US '866) and Kroger (US '989). This rejection is respectfully traversed.

See the above discussions regarding the disclosures of the cited prior art. None of the references provide any motivation which would lead one of ordinary skill in the art to modify the reactor of US '794 so as to provide heat exchange within the reactor itself between two successive reaction zones. In view of the above remarks, it is respectfully submitted that US '794, taken alone or in combination with US '243, US '866 and/or US '989, fails to render obvious applicants' claimed invention. Withdrawal of the rejection under 35 USC § 103 is respectfully requested.

Rejection under 35 USC §103 in view of Albano et al. and Luckenbach et al.

Claims 1, 2, 5-7, 11, 12, 14, 26, 29, 32, 40, 41 and 43 are rejected as allegedly being obvious in view of Albano et al. (US '022) in combination with Lengemann (US '866). This rejection is respectfully traversed.

This rejection was not applied against original claim 3, which has now been incorporated into claim 1. Neither of the references suggests modifying the reaction beds of US '022 so as to form the catalyst beds as moving beds. Compare applicants' claims 1, 48, and 49.

Furthermore, the focus and design of the reactor of US '022 are directed towards achieving a "uni-directional flow path" regardless of whether the reaction is endothermic or exothermic. The reason for this uni-directional flow path is to "effectively maintain the highest gaseous temperature in the core of the apparatus." See column 3, lines 51-57. Conversely, US '866 discloses a reactor that provides bi-directional flow. One of ordinary skill in the art would not look to the disclosure of US '866 to modify the reactor of US '022.

In view of the above remarks, it is respectfully submitted that US '022, taken alone or in combination with US '866, fails to render obvious applicants' claimed invention. Withdrawal of the rejection under 35 USC § 103 is respectfully requested.

Rejection under 35 USC §103 in view of Albano et al., Lengemann and Kroger

Claims 13, 37, 38, 42, and 47 are rejected as allegedly being obvious in view of Albano et al. (US '022) in combination with Lengemann (US 866) and Kroger (US '989). This rejection is respectfully traversed.

This rejection was not applied against original claim 3, which has now been incorporated into claim 1. Neither of the references suggests modifying the reaction beds of US '022 so as to form the catalyst beds as moving beds. Compare applicants' claims 1, 48, and 49.

Furthermore, as discussed above, the focus and design of the reactor of US '022 are directed towards achieving a "uni-directional flow path" regardless of whether the reaction is endothermic or exothermic. One of ordinary skill in the art would not look to the disclosure of US '866 to modify the reactor of US '022.

In view of the above remarks, it is respectfully submitted that US '022, taken alone or in combination with US '866 and/or US '989, fails to render obvious applicants' claimed invention. Withdrawal of the rejection under 35 USC § 103 is respectfully requested.

The Commissioner is hereby authorized to charge any fees associated with this response or credit any overpayment to Deposit Account No. 13-3402.

Respectfully submitted,

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